Accepted Manuscript

Analysis of the in-plane shear behaviour of non-orthogonally textile reinforcements: Application to braided fabrics

Shenglei Xiao, Peng Wang, Damien Soulat, Juliette Minet, Lilia Zemni, Hang Gao

PII: S1359-8368(18)31351-9

DOI: 10.1016/j.compositesb.2018.07.040

Reference: JCOMB 5807

To appear in: *Composites Part B*

Received Date: 1 May 2018

Revised Date: 17 July 2018

Accepted Date: 22 July 2018

Please cite this article as: Xiao S, Wang P, Soulat D, Minet J, Zemni L, Gao H, Analysis of the in-plane shear behaviour of non-orthogonally textile reinforcements: Application to braided fabrics, *Composites Part B* (2018), doi: 10.1016/j.compositesb.2018.07.040.

Analysis of the in-plane shear behaviour of non-orthogonally textile reinforcements: Application to braided fabrics

Shenglei Xiao [1, 2], Peng Wang [2, *], Damien Soulat [2], Juliette Minet [2], Lilia Zemni [2], Hang Gao[1]

[1] *Dalian University of Technology, School of Mechanical Eng. 116000 Dalian, China*

[2] *University of Lille, Ensait, Gemtex, F-59000 Roubaix, France*

* Corresponding author. Tel.: +33 3 20 25 89 47. Fax.: +33 3 20 25 64 61.
E-*mail address*: peng.wang@ensait.fr

Abstract: The characterisation of in-plane shear behaviour during textile reinforcement forming is one of the most important factors to insure the quality of the preforms before resin impregnation. All experimental and numerical studies on the in-plane shear behaviour concern orthogonally fabrics, interlaced by weaving or stitched for NCF preforms. In the present work, the in-plane shear behaviour of non-orthogonally interlaced fabrics manufactured by braiding is studied. Braided fabrics are widely used as textile reinforcements to manufacture advanced composite parts. Due to the non-symmetric structure of braided reinforcements, it is necessary to study this shear behaviour not only in axial direction but also in transversal direction. A geometric criterion and an analytical model for in-plane shearing characterisation by the bias-extension test are developed firstly for any textile structure. Then, two types of fabrics, Flax / PA12 and E-glass braided fabrics, are performed in bias-extension tests for validating the theoretical model. Analytical and experimental results present a good agreement that demonstrates the bias-extension test can be used to characterise the in-plane shear behaviour of braided reinforcements. Moreover, the in-plane shear behaviour of the braided samples with different ratios of length to width is also discussed to analyse the influence of the dimension ratio on tested samples. The results show that varying dimension ratio does not change the shear moment/shear angle behaviour but could affect the shear load/displacement behaviour.

Keywords: Textile composites; Braided fabric; In-plane shear; Forming; Characterisation